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## ABSTRACT

A search for better predictors of incomes of high school and college graduates is described. The accuracy of the prediction, implicit in the work of John R. Walsh of Harvard University, that the income differences in a given year are good indicators of income differences in future years, was tested by applying standard statistical procedures to data describing the annual incomes of men 25 years old and older during the period 1956 to 1975. Addition of the gross national product in the year prior to the previous equation yields much improved results. Application of Richard E. Freeman's three-equation recursive adjustment model indicates that the starting salaries of college graduates are not good correlates of income differences. Several sets of data from the American Council on Education "Fact Book on Higher Education" were then entered into a series of multiple correlation and regression studies. Studies of the 184 independent variables identified four that, taken together, yield significantly better predictions of future income differences. These factors were: (1) male population 22 years old, 13 years prior; (2) male college graduates at the B.A. and first-professional degree level/male population 29 years old, 11 years prior; (3) male college graduates at the B.A. and first-professional degree level, 14 years prior; and (4) male college graduates at the B.A. and first-professional degree level/male population 29 years old, 14 years prior. However, no theory to explain the connections among these variables is apparent. (SC)

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THE SEARCH FOR BETTER PREDICTORS OF INCOMES OF  
HIGH SCHOOL AND COLLEGE GRADUATES \*

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Each year millions of high school graduates forego substantial current income and spend millions of dollars to meet tuition, book, and other costs of investing in college and university education. They make these investments, in part, because they note the high value society places on the products and services of college graduates--a value evidenced by relatively high salaries and wages. The rates of return on these investments depend, to a large extent, on the differences between the future incomes of college graduates and the future incomes of persons of equal academic aptitude who do not pursue higher education.

The prediction that these differences in incomes will not change, i.e., that the income differences in a given year are good indicators of income differences in the next year, and in the next year, etc., is implicit in the work of John R. Walsh of Harvard, published in 1935. The accuracy of this prediction can be tested by applying standard statistical procedures to data describing actual income differences. Data describing the annual incomes of men 25 years old and older during the period 1956-1975 are available from the U.S. Bureau of Labor Statistics and the U.S. Bureau of the Census (1966).

The results of applying standard statistical procedures to this data describing the income experiences (in 1977 dollars, to offset consumer price inflation) of men 25 years old and older on the assumption that the differences in incomes of high school and college graduates one year predict income differences in the following year and in years following that are displayed

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in REPORT 1. While having such data is infinitely better than having no data at all, our predictions of future income differences on the basis of data from a single year are not very accurate.

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# REPORT 1

## Prediction of Income Differences Between Male High School and College Graduates 25 Years Old and Older 1956-75

|                              |           |
|------------------------------|-----------|
| Coefficient of determination | .5797     |
| Correlation coefficient      | .7616     |
| Constant term                | 2699.3672 |
| Standard error of estimate   | 481.1229  |

|                                    | Correlation<br>coefficient | Standard<br>error | Computed<br>t value | Beta  |
|------------------------------------|----------------------------|-------------------|---------------------|-------|
| Income differences<br>1 year prior | .6459                      | .1295             | 4.9859              | .7616 |

| Source of variation      | Degrees of<br>freedom | Sum of<br>squares | Mean<br>squares |
|--------------------------|-----------------------|-------------------|-----------------|
| Attributable to equation | 1                     | 57454400.0000     | 57454400.0000   |
| Deviation from equation  | 18                    | 4166626.0000      | 231479.2188     |
| Total                    | 19                    | 9921026.0000      |                 |

F value 24.86 significant between the .0000 and .0005 levels of confidence.

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In 1959 H. S. Houthakker increased the accuracy of income predictions by incorporating data describing the growth of the economy. Adding this measure-- gross national product in the year prior--to the equation predicting the income differences between male high school and college graduates 25 years old and older during the period 1956 through 1975 yields the much improved results displayed in REPORT 2.

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## REPORT 2

### Prediction of Income Differences Between Male High School and College Graduates 25 Years Old and Older 1956-75

|                                  |          |
|----------------------------------|----------|
| Coefficient of determination     | .7667    |
| Multiple correlation coefficient | .8756    |
| Constant term                    | 626.3516 |
| Standard error of estimate       | 368.9951 |

|                                        | Regression<br>coefficient | Std. error<br>of reg. coef. | Computed<br>t value | Beta  |
|----------------------------------------|---------------------------|-----------------------------|---------------------|-------|
| Income differences<br>1 year prior     | 1.0456                    | .1791                       | 5.8389              | .7238 |
| Gross National Product<br>1 year prior | .1880                     | .0298                       | 6.3177              | .7831 |

| Sources of variation       | Degrees of<br>Freedom | Sum of<br>squares | Mean<br>squares |
|----------------------------|-----------------------|-------------------|-----------------|
| Attributable to regression | 2                     | 7606351.0000      | 3803175.5000    |
| Deviation from regression  | 17                    | 2314675.0000      | 136057.3438     |
| Total                      | 19                    | 9921026.0000      |                 |

F value 27.93 significant between the .0000 and .0005 levels of confidence.

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In 1967 Richard B. Freeman published the following three-equation recursive adjustment model which seemed to hold great promise for improving the accuracy of predictions of income differences:

$$\begin{aligned}
 \text{"CSAL} &= -2.52 - .15 \text{ BA}(-1) + 1.1 \text{ DEM} + .31 \text{ ASAL} + .45 \text{ CSAL}(-1) \\
 &\quad (.02) \quad (.51) \quad (.24) \quad (.11) \\
 \text{Coefficient of determination} &= .994 \\
 \text{Standard error of estimate} &= .018 \\
 \text{Durbin-Watson statistic} &= 1.51
 \end{aligned}$$

$$\begin{aligned}
 \text{"BA} &= -.63 + .71 \text{ FRSH} [-4] + .29 \text{ FRSH} [-5] \\
 &\quad (.20) \quad (.20) \\
 \text{Coefficient of determination} &= .976 \\
 \text{Standard error of estimate} &= .061 \\
 \text{Durbin-Watson statistic} &= 0.55
 \end{aligned}$$

"FRSH = -2.02 + .88 POP + 1.31 [CSAL-ASAL] + .21 FRSH [-1]  
           (.21)       (.26)       [.16]  
           Coefficient of determination = .987  
           Standard error of estimate = .049  
           Durbin-Watson statistic = 1.79

"CSAL = a weighted average of college starting salaries (in constant dollars) taken from the annual survey of F. Endicott, "Trends in Employment of College and University Graduates in Business and Industry," (Placement Center, Northwestern University). The weights are .05 for accounting .35 for engineering, .20 for general business trainees, and .40 for sales.

"DEM = index of demand for college graduates, calculated by taking a fixed-weight index of employment in 46 industries.

"ASAL = average annual earnings (in constant dollars) the United States.

"BA = number of male bachelor's graduates.

"FRSH = number of first-degree, credit-enrolled males (pages 207 & 208)."

Unfortunately, analyses summarized in REPORT 3 indicate that the starting salaries of college graduates represented by CSAL are not good correlates of income differences between male high school and college graduates 25 years old and older during the period 1956-75.

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### REPORT 3

#### Prediction of Income Differences Between Male High School and College Graduates 25 Years Old and Older 1956-75

|                              |           |
|------------------------------|-----------|
| Coefficient of determination | .3965     |
| Correlation coefficient      | .6297     |
| Constant term                | 3196.4385 |
| Standard error of estimate   | 576.7010  |

(continued)

## REPORT 3 (continued)

|      | Regression<br>Coefficient | Std. error<br>of reg. coef. | Computed<br>t value | Beta  |
|------|---------------------------|-----------------------------|---------------------|-------|
| CSAL | .0403                     | .0117                       | 3.4395              | .6297 |

| Source of variation        | Degrees of<br>freedom | Sum of<br>squares | Mean<br>squares |
|----------------------------|-----------------------|-------------------|-----------------|
| Attributable to regression | 1                     | 3934512.0000      | 3934512.0000    |
| Deviation from regression  | 18                    | 5986514.0000      | 332584.1250     |
| Total                      | 19                    | 9921026.0000      |                 |

F value 11.83 significant between the .0000 and .0050 levels of confidence.

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Searching for more accurate predictors of income differences, I entered each of the following sets of data from the American Council on Education Fact Book on Higher Education, in turn, into a series of multiple correlation and regression studies:

CSAL 1, 2, 3, 4, 5, 6, 7, 8, and 9 years prior.  
Income differences between male high school and college graduates age 25--2, 3, 4, and 5 years prior.  
Gross National Product 2, 3, 4 . . . 9 and 10 years prior.  
Male population, age 22--1, 2, 3 . . . 16 and 17 years prior.  
Male college graduates at the B.A. and first professional degree levels 1, 2, 3 . . . 16 and 17 years prior.  
Unemployment rates of men 20 years old 1, 2, 3, 4, 5, and 6 years prior.  
Per capita income 1, 2, 3 . . . 9 and 10 years prior.  
Median years of school completed by men age 25 and over 1, 2, 3 . . . 16 and 17 years prior.  
Birth rate 1, 2, 3 . . . 45 and 46 years prior.  
Ratio of first time college enrollees to high school graduates 1 year prior.  
Ratio of college enrollees to college age population 0 and 1 year prior.  
Higher education expenditures as a percentage of GNP 1, 2, 3 . . . 27 and 28 years prior.  
Income differences between male high school and college graduates age 22--6, 7, and 8 years prior.  
Male college graduates at the B.A. and first professional degree level divided by the male population age 29--1, 2 . . . 14 and 15 years prior.

These studies of 184 independent variables identified four which taken together yield the results displayed in REPORT 4. Our ability to make such

better predictions of future income differences, while useful, leaves us dissatisfied because we have no theory to explain the connections among these variables. We stand like Tycho Brahe with data which yield accurate predictions waiting for a Johannes Kepler and an Isaac Newton to supply the unifying theory! How can we increase the accuracy of our predictions? Who will write the explanatory theory?

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REPORT 4

Prediction of Income Differences  
Between Male High School and College Graduates  
25 Years Old and Older 1956-75

|                                  |            |
|----------------------------------|------------|
| Coefficient of determination     | .8116      |
| Multiple correlation coefficient | .9009      |
| Constant term                    | 13925.8457 |
| Standard error of estimate       | 353.0499   |

|                                                                                                                                      | Regression<br>Coefficient | Std. error<br>of reg. coef. | Computed<br>t value | Beta    |
|--------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------|---------------------|---------|
| Male population<br>22 years old,<br>13 years prior.                                                                                  | -6.1292                   | 2.2641                      | -2.7072             | -.5486  |
| Male college graduates<br>at the B.A. and first<br>professional degree<br>level/male population<br>29 years old, 11 years<br>prior.  | .0408                     | .0163                       | 2.5038              | .3447   |
| Male college graduates<br>at the B.A. and first<br>professional degree<br>level, 14 years prior.                                     | -.0176                    | .0119                       | -1.4802             | -2.0070 |
| Male college graduates<br>at the B.A. and first<br>professional degree<br>levels/male population<br>29 years old, 14 years<br>prior. | .1748                     | .1357                       | 1.2879              | 1.8349  |

(continued)

# REPORT 4 (continued)

| Source of variation        | Degrees of freedom | Sum of squares | Mean squares |
|----------------------------|--------------------|----------------|--------------|
| Attributable to regression | 4                  | 8051364.0000   | 2012841.0000 |
| Deviation from regression  | 15                 | 1869663.0000   | 124644.2031  |
| Total                      | 19                 | 9921028.0000   |              |

F value 16.15 significant between the .0000 and .0005 levels of confidence.

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